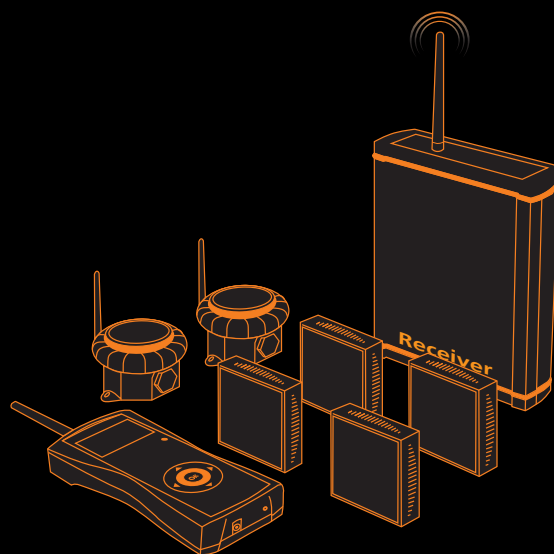




Manual

Wireless Sensing System

Site Survey Kit (SSK)



Sontay® SonNet Radio Sensor Site Survey Tool

User Manual

Version 1.8

June 2011

Audience

This manual is intended for specifiers, users and installers of the Sontay® SonNet radio sensor system.

Content

This manual provides a complete reference for the Sontay® SonNet radio Site Survey system.

Related Documents

The Sontay® SonNet radio sensor system Site Survey Kit Quick Start Guide

The Sontay® SonNet radio sensor system User Manual

The Sontay® SonNet radio sensor system Quick Start Guide

The Sontay® SonNet radio sensor system product datasheets

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Overview

The wireless nodes are based on direct-sequence spread spectrum (DSSS) communication in the 2.4 - 2.5GHz band, compliant with IEEE 802.15.4-2006.

All nodes have a unique MAC address, equivalent to a unique serial number.

All devices have an on/off switch.

All nodes retain their configuration properties across a power failure.

Environmental

- Storage temperature range of -10 to +80°C
- Storage relative humidity range of 0 to 90% (non-condensing).
- Ambient (operating) temperature range of -10°C to +50°C
- Ambient (operating) relative humidity range of 0 to 90%, (non-condensing).

Battery Charging

To charge the battery in an SSK (site survey kit) node, connect the correct charger to the socket on the back plate *BEFORE SWITCHING THE CHARGER ON*. Switch the charger on, the status LED on the charger will show red until the battery is fully charged, when the status LED will turn green.

To charge the battery in an SSK router, connect the correct charger to the socket mounted on the side of the housing *BEFORE SWITCHING THE CHARGER ON*. Switch the charger on, the status LED on the charger will show red until the battery is fully charged, when the status LED will turn green. NB - the same charger type is used for both SSK nodes and SSK routers.

To charge the battery in the HHM (hand held monitor), connect the correct charger to the socket located on the bottom of the housing. The status LED visible through the HHM keypad will show orange until the battery is fully charged, when the status LED will go out.

To charge the battery in an SSK receiver, connect the correct charger to the charger socket. The status LED on the charger will show red until the battery is fully charged, when the status LED will turn green.

Note that when charging SSK batteries, the electronics are disconnected from the rest of the device, and therefore that device will not function until charging is complete. Only the battery is connected to the charger.

Only the correct chargers must be used for each SSK device. Batteries will be damaged if not charged by the correct charger.

SSK Functional Overview

The Sontay® SonNet Site Survey Kit (SSK) is designed to make the design and installation of a SonNet radio sensor system simple and quick and to take the guesswork out of the radio communications aspect of the network.

The SSK receiver should be placed where the actual RF-RX system receiver will be installed (typically in a plant room or riser).

The hand-held monitor (HHM) communicates with the SSK receiver (via a router, if necessary), and the LCD display shows which nodes are on-line and the quality of the radio link to their “parent” devices.

Follow the step-by-step guide to determine where to position the receiver, any routers necessary, and to test that all sensor nodes can communicate with the receiver reliably when installed.

The SSK is housed in a robust case, and contains:

- 1 x SSK receiver
- 1 x hand-held monitor (HHM)
- 4 x battery powered SSK sensor nodes
- 2 x SSK routers
- 1 x charger unit for the SSK receiver
- 1 x charger unit for the HHM
- 2 x charger units for the SSK nodes and routers
- SSK Quick Start Guide
- SSK User Manual

Verification Mode

Verification mode is a special mode that an SSK node or router can adopt specifically to test the LQI to another device. In this special mode, the device ignores the normal hierarchical rules used to form a robust network, and relies solely on signal strength. When a device is requested to go into verification mode, it will briefly drop off the radio network and, having rebooted, reappear running in verification mode. Note that a device placed in to verification mode will automatically reboot back into normal mode after 5 minutes if left unattended. Power-cycling a device in verification mode will also return that device to normal mode.

To place a device in verification mode, select the device from the list by using the Up/Down arrow keys, then press the right arrow key. Using the Up/Down arrow keys to select “verify”, then press the OK key. The device will go off-line for a few seconds, before re-joining the network in verification mode.

Notes:

- In the final installation, routers can also be sensors. However, they require a permanent 24Vac/dc supply.
- Each router can support a maximum of 16 “children”, which can consist of a maximum of 8 battery powered nodes and 8 routers, or up to 16 routers if there are no battery powered end devices (EDs). In most circumstances, it is advised that, unless unavoidable, no more than 8 “children” should be connected to a single router, to allow for redundancy in case of router failure or damage.
- SSK nodes are fitted with a thermistor temperature element, and will report temperature and battery status to the HHM or CMS (configuration and monitoring software). SSK routers are not fitted with temperature sensing elements, and will only report link qualities and battery status.

Battery Fitting and Replacement

When a battery is first installed, or when it is replaced, observing the correct polarity is very important. Fitting the battery incorrectly may result in permanent damage to the sensor.

Recommended batteries are:

Nodes and routers: 3.7V Lithium Polymer, rechargeable 1080mAh
(Uniross U0110952)

Hand Held Monitor (HHM): 3.6V NiMH, rechargeable 580mAh
(Varta 3/V600HR WIRE)

SSK Receiver: 12V NiMH, 2100mAh, 10 x AA cell rechargeable pack (Strikalite 752)

Batteries should be stored in a clean, cool (not exceeding +30°C), dry and ventilated area.

Disposal of Batteries - Warning! Fire, Explosion and Burn Hazard

Do not short-circuit, crush, disassemble, heat above 100°C (212°F), incinerate, or expose the battery contents to water. Do not solder directly to the cell.

All batteries must be disposed of in accordance with EC Directive 2006/66/EC, amended by EU Directive 2008/12/EC.

SSK Part Codes:

RF-SSK – Site Survey Kit

RF-RXSS - Receiver module (no outputs)

RF-HHT - Handheld monitor

RF-TS-900 - Temperature SSK sensor

RF-PS-500 - SSK Router

SSK Nodes

RF-TS-900 nodes are used in conjunction with the Sontay® **RF-RXSS** receiver, **RF-PS-500** routers and **RF-HHT** hand held monitor.

Data is transmitted back to the receiver every 30 seconds. Each sensor retains these configurations if the battery becomes discharged or requires replacement.

NB - To preserve battery life, an SSK node will automatically go off-line after approximately 4 hours if not power-cycled.

To charge the battery in an SSK node, connect the correct charger to the socket on the back plate. The status LED on the charger will show red until the battery is fully charged, when the status LED will turn green.

To power an SSK node, the battery must be connected and the On/Off rocker switch on the backplate should be switched to the On position. To switch off, the On/Off rocker switch on the backplate should be switched to the Off position. Refer to datasheet.

The sensors automatically find the best path back to the receiver, which may be directly to the receiver or via "parent" routers.

- SSK nodes have a thermistor temperature sensor fitted as standard.

SSK Node Specification:

Radio Output:

Frequency	2.4GHz
16 channels, automatically selected	
Direct-sequence spread spectrum	
Compliance	IEEE 802.15.4-2006

Aerial Characteristics

Gain	1.2dBi
VSWR	1.5:1

Data Encryption: AES 128

Power Output: 0dBm (1mW @ 50Ω)

Temperature accuracy ±0.3°C

Battery Type: 3.7V Lithium Polymer, rechargeable, 1080mAh

Housing Material: ABS (flame retardant)

Dimensions: 85 x 85 x 23mm

Environmental:

Operating:

Temperature	-10°C to +50°C
RH	0 to 90%, non-condensing

Storage:

Temperature	-10°C to +80°C
RH	0 to 90%, non-condensing

Country of origin: UK

Part Code: **RF-TS-900**

Refer to product datasheet for installation instructions.

SSK Routers

RF-PS-500 SSK routers are used in conjunction with the Sontay® **RF-RXSS** receiver, **RF-TS-900** nodes and **RF-HHT** hand held monitor, and are used to route signals from battery powered nodes and other routers to the receiver module, where the signal strength of a direct path is not sufficient for reliable communications.

NB Each router can support a maximum of 16 “children”, which can consist of a maximum of 8 battery powered nodes and 8 routers, or up to 16 routers if there are no battery powered end devices (EDs). Consideration should be given on network planning for redundancy in case of router failure or damage.

Routers automatically find the best path back to the receiver, which may be directly to the receiver or via other “parent” routers.

NB To preserve battery life, an SSK router will automatically go off-line after approximately 4 hours if not power-cycled.

To charge the battery in an SSK router, connect the correct charger to the socket mounted on the side of the housing. The status LED on the charger will show red until the battery is fully charged, when the status LED will turn green. **NB** - the same charger type is used for both SSK nodes and SSK routers.

To power an SSK router, the battery must be connected and the On/Off toggle switch on the housing side should be switched to the On position. To switch off, the On/Off toggle switch on the housing side should be switched to the Off position. Refer to datasheet.

- SSK routers do not have a temperature sensor fitted.

SSK Router Specification:

Radio Output:

Frequency 2.4GHz
16 channels, automatically selected
Direct-sequence spread spectrum
Compliance IEEE 802.15.4-2006

Aerial Characteristics

Gain 2.0dBi
VSWR <2:1

Data Encryption: AES 128

Power Output: +10dBm (10mW @ 50Ω)

Battery Type: 3.7V Lithium Polymer, rechargeable, 1080mAh

Housing:

Material ABS (flame retardant type VO)
Dimensions 55mm x 90mm dia.
Mounting holes 4mm spaced 85mm apart

Environmental:

Operating:

Temperature -10°C to +50°C
RH 0 to 90%, non-condensing

Storage:

Temperature -10°C to +80°C
RH 0 to 90%, non-condensing

Country of origin: UK

Part Code: **RF-PS-500**

Refer to product datasheet for installation instructions.

The SSK Receiver

The Sontay® **RF-RXSS** receiver collects data from all other devices on the SSK radio network, including measurements from sensors, link quality for all links formed in the network, battery levels for all battery powered devices, hours run for all devices and the current status of all devices.

NB There are no analogue outputs on an **RF-RXSS**. The SSK receiver is used solely to determine signal strengths and whether routers need to be added to a network to achieve complete, reliable coverage.

Data is transmitted back to the receiver at pre-configured time intervals.

A USB socket is provided for connection to a PC or laptop running the Sontay SonNet CMS software.

To power the SSK receiver, turn the On/Off switch on the housing cover to ON. To switch off, turn the On/Off switch on the housing cover to OFF.

To charge the battery in an SSK receiver, connect the correct charger to the socket. The status LED on the charger will show red until the battery is fully charged, when the status LED will turn green.

SSK Receiver Specification:

Radio Output:

Frequency	2.4GHz
16 channels, automatically selected	
Direct-sequence spread spectrum	
Compliance	IEEE 802.15.4-2006

Aerial Characteristics

Gain	2.0dBi
VSWR	<2:1

Data Encryption: AES 128

Power Output: +10dBm (10mW @ 50Ω)

Power Supply: Internal 12Vdc NiMH battery, 2.1Ah

Serial communications: USB 2.0

Environmental:

Operating:

Temperature	-10°C to +50°C
RH	0 to 90%, non-condensing

Storage:

Temperature	-10°C to +80°C
RH	0 to 90%, non-condensing

Country of origin: UK

Part Code: **RF-RXSS**

Refer to product datasheet for installation instructions.

The SSK Hand Held Monitor

The Sontay® **RF-HHT** displays all on-line receivers, routers and nodes in the SSK radio network, and shows link quality for all links formed in the network, battery levels for all battery powered devices, hours run for all devices and the current status of all devices.

To switch on the HHM, press and hold the OK key for approximately 1 second. To switch off, press and hold the OK key for at least 2 seconds. The HHM will beep to indicate that it is shutting down.

To charge the battery in the HHM, connect the correct charger to the socket located on the bottom of the housing. The status LED visible through the HHM keypad will show orange until the battery is fully charged, when the status LED will go out.

SSK HHM Specification:

Radio Output:

Frequency	2.4GHz
16 channels, automatically selected	
Direct-sequence spread spectrum	
Compliance	IEEE 802.15.4-2006

Aerial Characteristics

Gain	2.0dBi
VSWR	<2:1

Data Encryption:

AES 128

Power Output:

+10dBm (10mW @ 50Ω)

Power Supply:

Internal 3.6Vdc NiMH battery, 580mAh

Environmental:

Operating:

Temperature	-10°C to +50°C
RH	0 to 90%, non-condensing

Storage:

Temperature	-10°C to +80°C
RH	0 to 90%, non-condensing

Country of origin:

UK

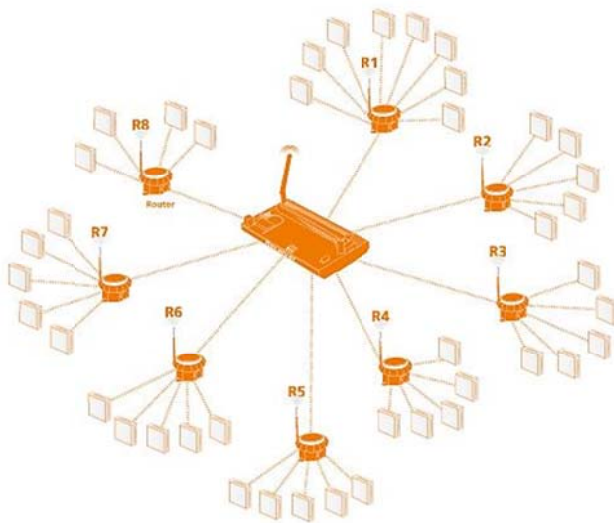
Part Code: **RF-HHT**

Refer to product datasheet for installation instructions.

The Radio Network

A Sontay® SonNet radio system is comprised of a receiver, battery powered sensors and permanently powered routers.

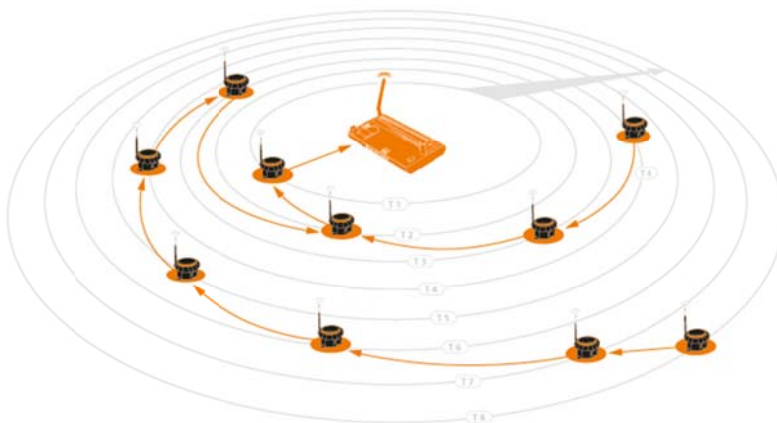
Routers, though permanently powered, can also have sensing elements, accomplishing both router and sensors functions. Routers and sensors can either communicate directly with the receiver or *via* other routers. Routers are required to be permanently powered as they need to stay “awake” at all times to allow signals from “child” nodes to be instantly forwarded to their “parent” nodes. Battery powered sensors only “wake” for very short periods to send data.



In the schematic above, routers **R2 to R7** have 5 children each, all battery powered sensors. Their parent is the receiver. Router **R1** has 6 children and **R8** has 4 children, giving a total number of network devices of 50, including the receiver.

The receiver can support a **maximum** of 16 directly connected “child” devices, of which only 12 can be battery powered nodes, plus up to 4 routers.

Routers can support a **maximum** of 16 directly connected “child” devices, of which only 8 can be battery powered nodes, plus up to 8 routers.



There can be a maximum depth of 8 layers of routers in a network and a maximum of 50 nodes per network with the **RF-RX** series of receivers.

Note that battery powered devices can only route their signals to the receiver directly or through routers, and **not through other battery powered devices**.

When planning a SonNet radio network, it is recommended that the Sontay[®] SonNet Site Survey Kit be used. This easy-to-use package allows installers to test signal strengths between locations required for battery powered sensors and the receiver prior to installing the full system. It can also identify whether routers are needed to ensure reliable communications between all devices on the network back to the receiver. This removes any guesswork from planning a system and allows the installer to order exactly and only the devices required.

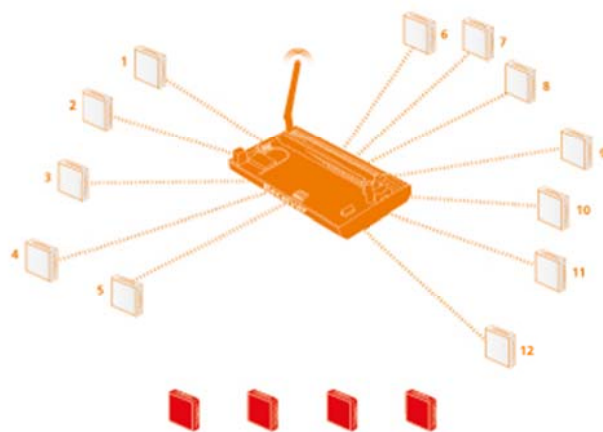
See the Sontay[®] SonNet radio sensor system Site Survey Kit Quick Start Guide and The Sontay[®] SonNet radio sensor system Site Survey Kit Manual for full details.

Network Planning Considerations

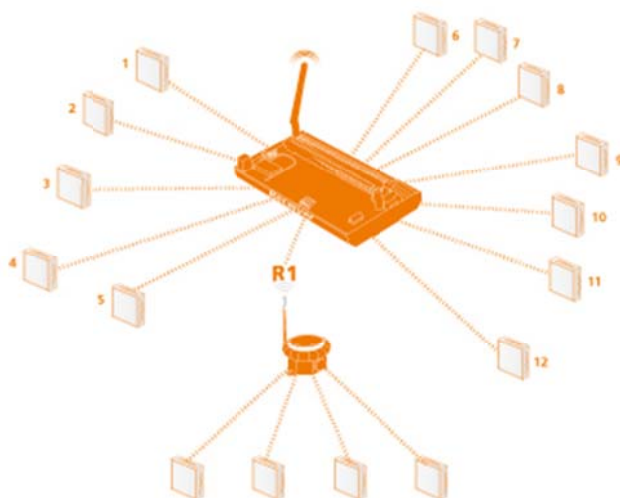
When planning a SonNet radio system, it is always worth considering the placement of routers, and should be capable of handling the consequences of a router failing or being damaged.

Example:

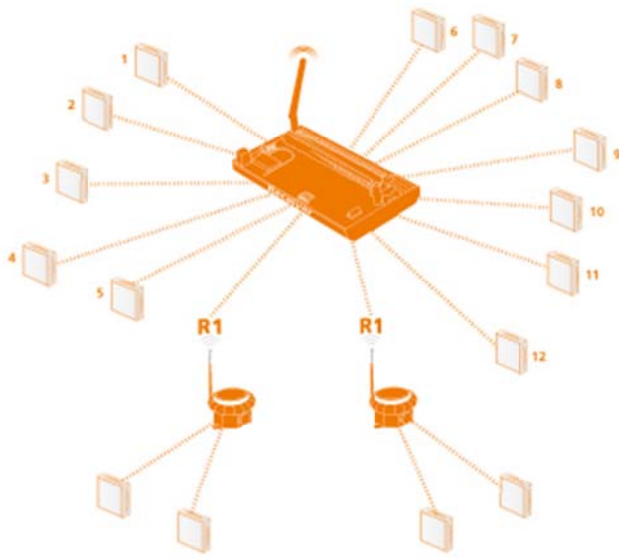
Consider a network with a requirement for 16 EDs:



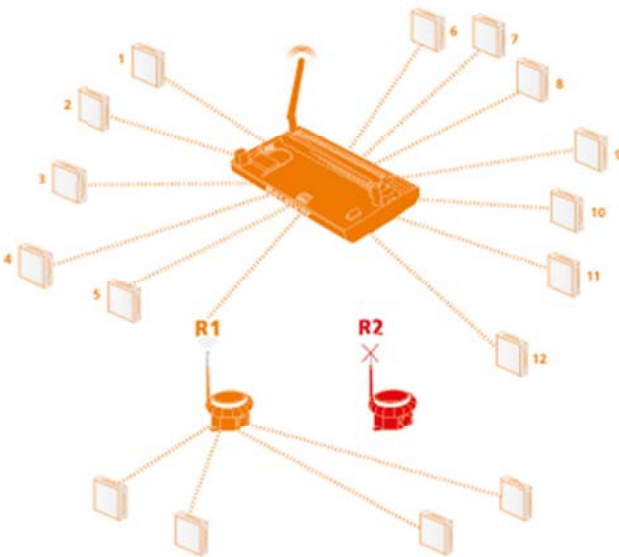
1. At least one router is required, as 16 directly connected EDs will exceed the maximum limit of 12. Four EDs will be orphaned.



2. A single router (R1) will work, but gives no redundancy if the router should fail.



3. Optimal network uses 2 routers, R1 and R2.



4. If either of the routers fail, the network can still be maintained, as the 2 orphaned EDs can re-route via the other router.

The Radio System

The radio system used by the Sontay SonNet devices is divided into 3 sections or 'layers'.

1. The radio layer is where physical control of the radio signal is done. This conforms to international standard 802.15.4, and determines the frequency of the radio signals, the number of 'channels' available for use, the bandwidth and power level of the signal etc. There are 16 channels available, and the best one is automatically selected by the receiver. The frequencies used are in the ISM (Industrial, Scientific and Medical) 2.4GHz band, with a maximum data rate of 250kb/s.
2. The network management layer is where the self-healing tree functionality is run, which controls network topology. 'ZigBee' is an example of a network management MESH protocol. SonNet does not use ZigBee, but instead uses a 'self-healing tree' protocol to control network topology.
3. The application layer is what determines what the device does – i.e. makes it a temperature sensing device, a router or a receiver. SonNet devices use specific applications, and include features such as configuration properties.

Security

All SonNet system devices have the same, unique network identifier. Only devices with the correct ID will be allowed to join the network. The ID used by system devices is different from the ID used for site survey kit (SSK) devices. Hence, SSK devices cannot join a system network and vice versa. When a SonNet system network has been formed, it can be 'locked' to prevent any unauthorised devices joining, even if they are SonNet devices. The CMS can be used to authorise extra SonNet system devices if required.

All data transmitted by SonNet devices is encrypted.

How the Self-Healing Tree Network Is Formed

The network is formed based on 3 rules, and in a specific order of priority:

1. How many 'tiers' a device is away from the receiver.

If a device can communicate directly with the receiver, it will, even if the link quality is poorer than if it went through a router. If a device has a choice of more than one router, it will always choose the router closest to the receiver (the least number of tiers away), even if the link quality is marginal.
2. The number of 'child' devices a router already has.

A router can have a maximum of 16 'children'. If a device has a choice of more than one router of the same tier level, it will always choose the router with the least number of children, even if the link quality is marginal.
3. Signal Strength (link quality).

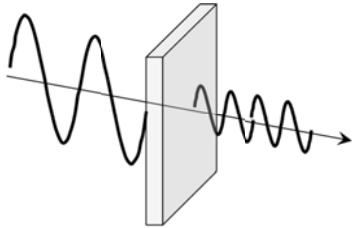
Finally, if a device has a choice of more than one router of the same tier level and the same number of children, it will choose the router with the best link quality.

If, for any reason, a device (node or router), loses its preferred path back to the receiver, it will automatically search for an alternative – still obeying the 3 rules above in sequence. If, despite employing Direct Sequence Spread Spectrum (DSSS) techniques, interference on the currently occupied channel prevents communications, the receiver will automatically look for another channel which is clear. All other devices, having lost their links to the receiver, will then also automatically scan the 16 channels until they find the receiver again, and the network will re-form without user intervention.

Propagation Of Radio Signals In Buildings

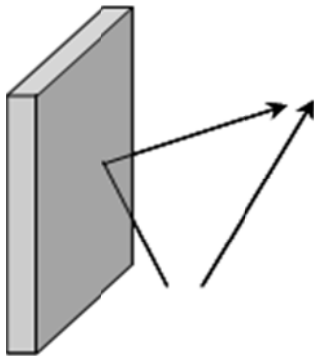
The propagation of microwave radio signals in a building can be affected in several ways:

Attenuation



Radio signal strength is attenuated when it passes through air. Signals are attenuated much more when passing through other media, such as materials typically used in construction, such as brick, stone, wood and especially steel.

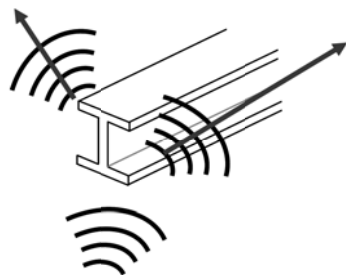
Reflection



Depending on the building, radio signals can take many paths from the transmitter to the receiver, rather than just one single path.

'Multipath' signals can have the effect of cancelling each other out, reducing overall received signal strength.

Scattering



Scattering the radio signal can also reduce its signal strength.

FAQs

a. *How is access to the sensor network locked at the CMS?*

Nodes are only allowed to join the network if the receiver allows them to. This is true even if the nodes are identified as SonNet Nodes and have the correct encryption key.

There are two methods to configuring the receiver to accept nodes on to the network. In order to authorise a node the CMS must be in administration mode (File->Switch Admin Mode must be ticked).

- Auto-Commissioning Mode

The CMS allows the receiver to be switched to auto-commissioning mode. In this mode any nodes that can correctly identify themselves as SonNet nodes will be allowed to join the network. Any nodes that do join will be added to the CMS textual display.

- Manual Mode

In manual mode individual nodes can be removed from or added to the authorised node list from the CMS. Manual mode is the default mode.

A node can then be authorised by Options->Authorise (add) a new node or selecting the same option on the right click menu in the Textual or Graphical parts of the application display.

The user must type the MAC address (on PCB and product housing) of the new node into the dialog that appears and can also give the node a textual name (up to 10 characters)

b. *Why do some menu items disappear if the CMS application is idle for some time?*

The CMS has a timeout that operates when in Admin mode. If there is no activity for some time the CMS application will exit admin mode and some admin menu items will be disabled or removed.

The timeout can be set in Options-> Change Idle Time.

Admin mode can be entered again in File->Switch Admin Mode

c. *The CMS application right click menu has stopped being provided. Why?*

This probably means that the CMS has detected that the receiver has been disconnected from the PC. This will be indicated on the status bar at the bottom left side of the CMS application window "Receiver Disconnected". In this state many of the CMS facilities are disabled until the Receiver is connected again.

d. *How are the network node names stored, are they persistent?*

The node names are stored in the receiver hardware in non-volatile memory. Therefore these will be the same even if a different PC is attached to the system, or the receiver is reset / power cycled.

e. *In the CMS application what is an Unknown node?*

The application will list all nodes that have been added to the system as unknown initially. As soon as a node is added (either manually or by the use of auto commissioning mode) a request is sent to it to establish what type of node it is and what capabilities it has.

As a result a node will be categorized as unknown until a response is received from it. If the node remains off-line or does not respond for any other reason it will remain in this category.

The CMS will send a request each time it is started if there are still unknown nodes in the system.

Using the SSK with SonNet Configuration and Monitoring Software (CMS)

Although not necessary to undertake a site survey, CMS can be used with the SSK if required. After installing CMS (see user manual), connect the SSK receiver to a free USB port on the CMS PC. After the drivers are installed, CMS can be used to textually and graphically display the SSK network.

It can be used for;

- Adding or removing nodes¹
- Providing a text and graphical display of the network
- Monitor device status
- Monitor link and battery quality
- View logs for receiver configuration changes

¹ All nodes, router and the HHM are pre-configured into the SSK receiver. No further authorization of nodes should be needed. Note that system devices cannot be authorized in an SSK receiver. If SSK devices need to be authorized to an SSK receiver, it must be done manually, as auto-commissioning mode does not function with SSK receivers.

The CMS installation procedure installs 3 components:

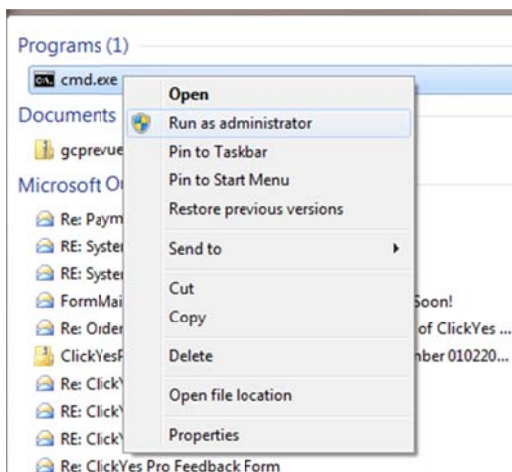
- Microsoft® SQL Server 2005 Express Edition SP2
- Sontay® SonNet CMS
- Sontay® device USB device drivers

NB It is important that the CMS installation be completed prior to connecting the PC to the receiver.

Important – Windows 7 Users

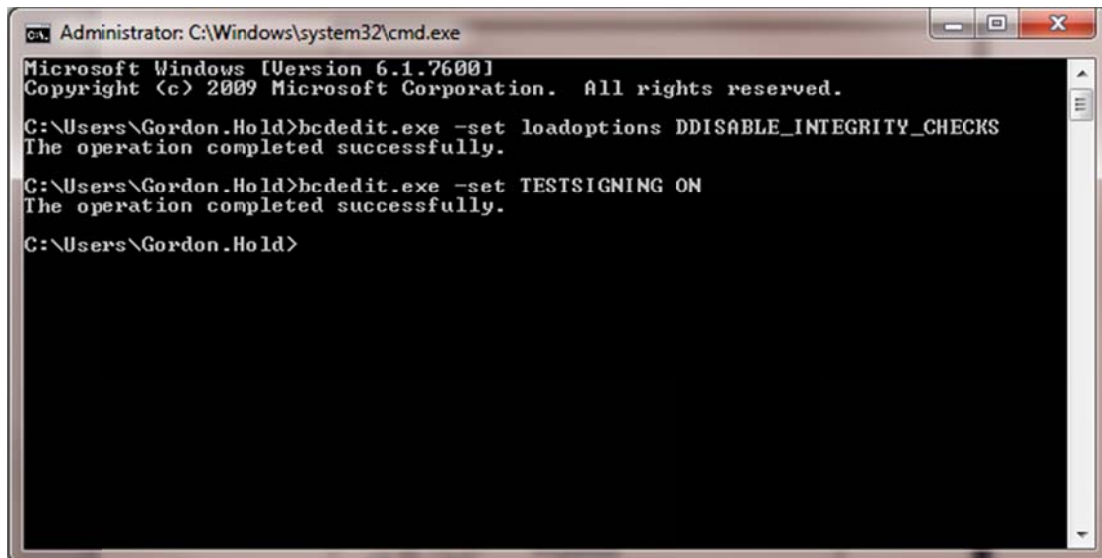
Prior to installing CMS, it is important to turn off driver signing.

From the Start menu, type cmd.exe in the search bar. Right click on cmd.exe and choose run as administrator.

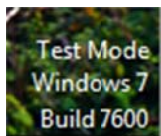


Run the following commands in the shell.

```
bcdedit.exe -set loadoptions DDISABLE_INTEGRITY_CHECKS  
bcdedit.exe -set TESTSIGNING ON
```



Restart the PC. When logged, the following will be displayed in the bottom right corner of the desktop:

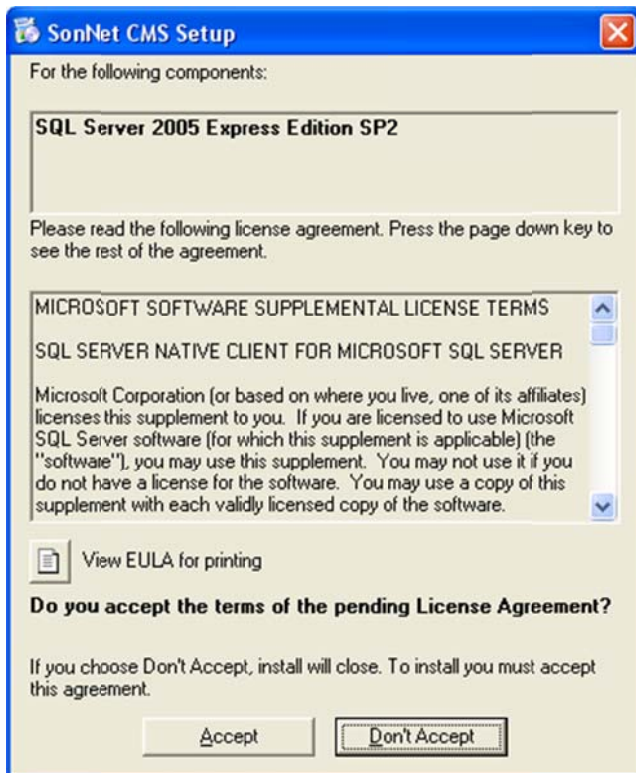


Microsoft® SQL Server 2005 Express Edition SP2 is installed first, if not already installed, followed by Sontay® SonNet CMS and finally the Sontay® device USB device drivers.

Note that there is an issue with SQL Server 2005 Express Edition SP2 and MSXML 6 SP2 (see Microsoft Knowledge Base article KB954459 for full details). To overcome this, the CMS installation will offer to run the Windows Installer Cleanup Utility to uninstall MSXML6 SP2. When this message appears, click on the [Install](#) button.



Installing CMS



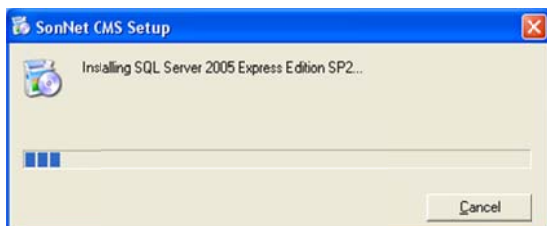
NB It is important that the CMS installation be completed prior to connecting the PC to the receiver. Ensure that the PC on which you are installing CMS is NOT connected to the receiver until the installation is complete.

CMS is compatible with Microsoft® Windows XP SP2 or later, Microsoft® Vista and Microsoft® Windows 7. The CMS installation CD comes with all required programme files and drivers, and includes SQL Server 2005 Express Edition SP2.

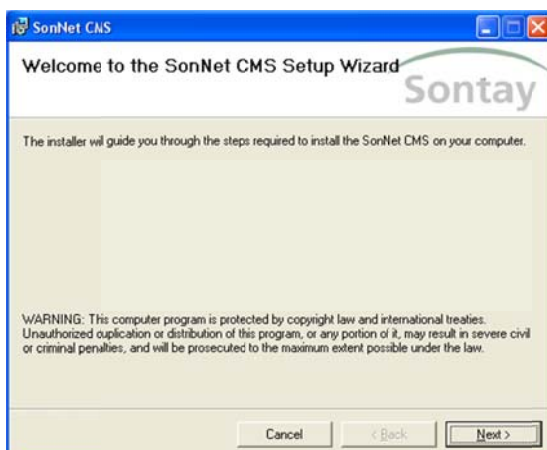
NB You must be logged in to Windows with an administrator level user account to install CMS and SQL Server 2005 Express Edition SP2.

If SQL Server 2005 Express Edition SP2 is not already installed on your PC, the following installation will be executed.

When the SQL Server 2005 Express Edition SP2 installation window appears, read the EULA and then click the <Accept> button.

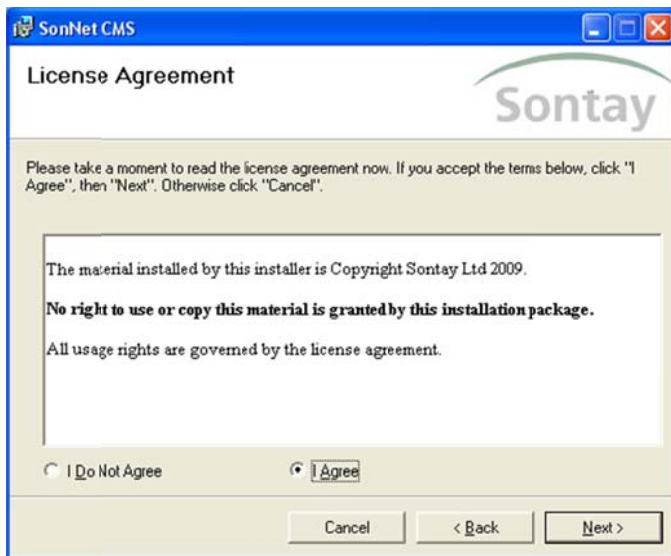


The installation of SQL Server 2005 Express Edition SP2 continues until complete.

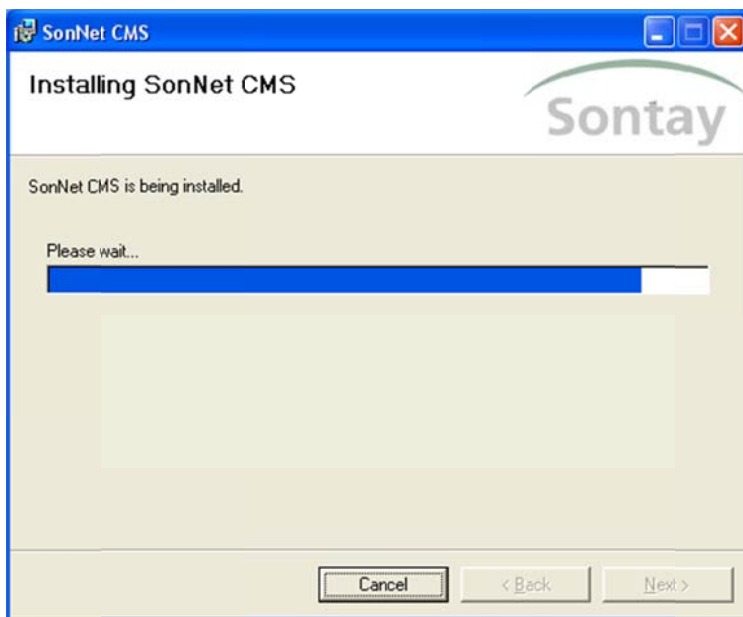


The next step in the installation procedure will display the "Welcome to the SonNet CMS Setup Wizard. Click the <Next> button to continue.

Click <I Agree> and then the <Next> button to continue.

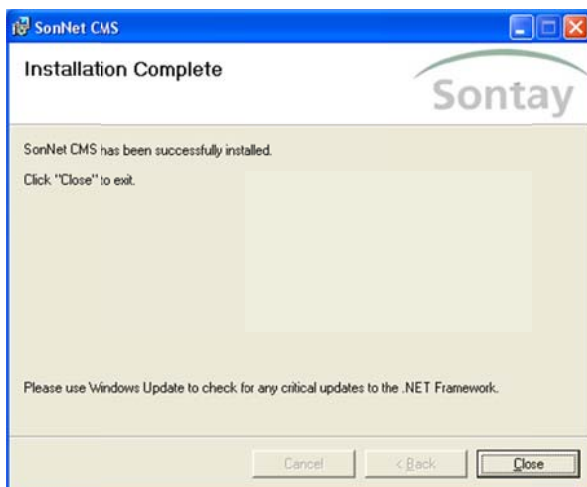


SonNet files are copied to your PC.



A separate window opens to allow the installation of the 2 device drivers are required for the USB receiver connection.

To install these, click the [Next](#) button to continue.



When the installation is complete, click the [Close](#) button.

Starting CMS

When the receiver is first connected to a USB port and switched on, the device manager will detect a new device. Follow these steps to install the drivers for the receiver.



Select the option shown ("No, not this time")



Select the option shown ("Install the software automatically")

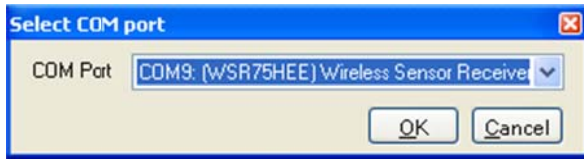


If advised that the drivers have not passed Windows Logo testing, or are not digitally signed, click "Continue Anyway"

There are 2 drivers to be installed, follow the same procedure for both drivers.

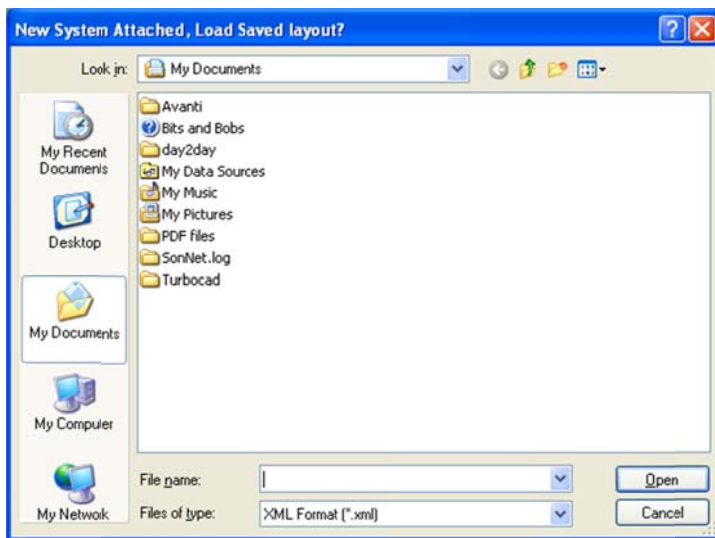
When CMS is started, the PC com port connected to the receiver USB port needs to be defined.

Using the drop-down list box, select Wireless Sensor Receiver.



Importing a Saved Layout

When first run, CMS may also ask if the user requires a saved XML layout file to be imported. This is useful if an existing layout has been saved on a site where the PC running CMS has been replaced.



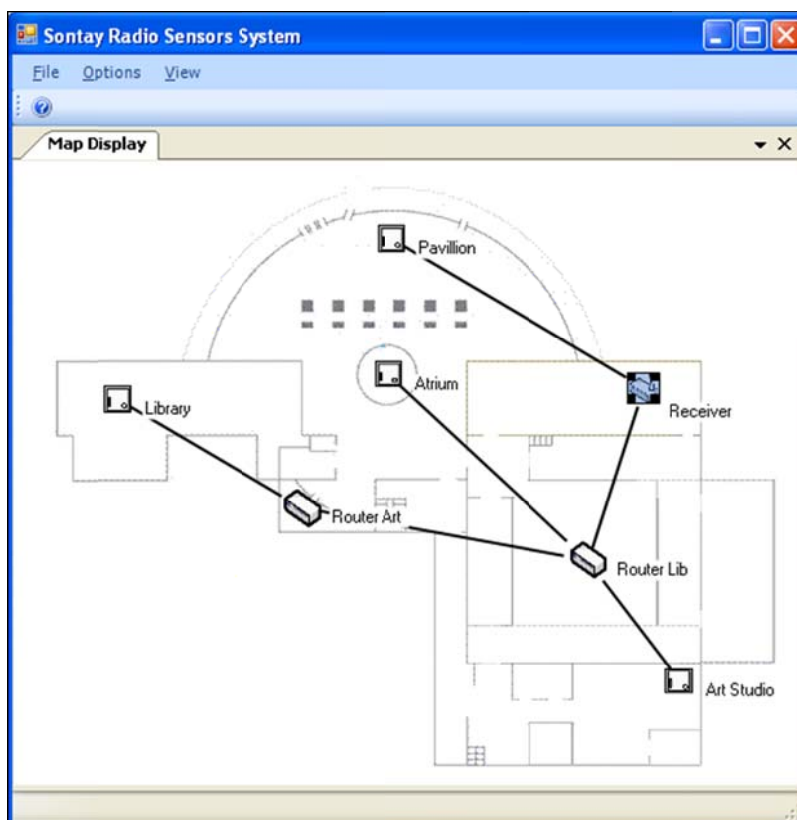
If no layout file is required, click the <Cancel> button to continue, otherwise navigate to the saved layout file to and click the <Open> button import it.

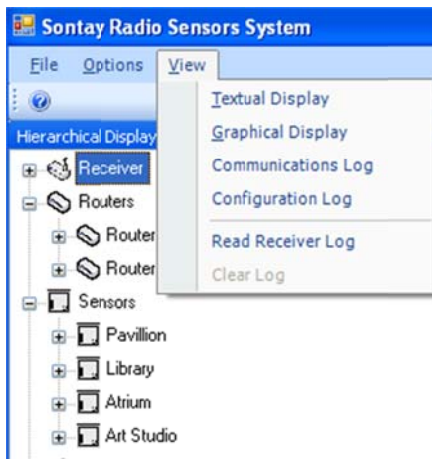
The CMS Desktop Environment

The CMS desktop is divided into 2 parts, a textual hierarchical display



and a graphical "map" display.





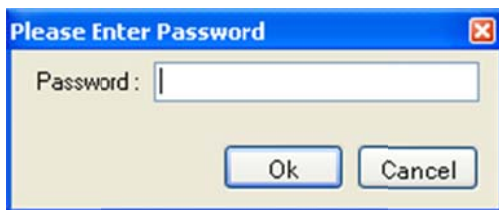
To enable the text display panel, from the menu bar choose <View> then <Textual Display>

To enable the graphical display panel, from the menu bar choose <View> then <Graphical Display>

Logging On as an Administrator

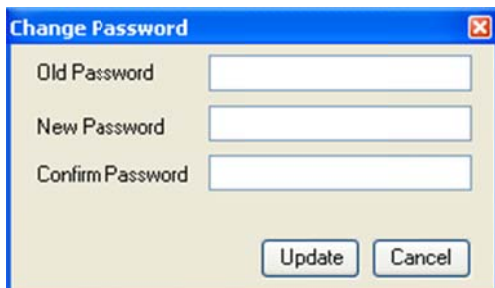


To make any changes to device configuration or to create or modify the graphical display, you must first log on as an administrator. To do this, from the menu bar choose <File> then <Switch Admin Mode>



The login box appears. Type in your admin level password. NB The default admin level password is admin (case sensitive). This can be changed once you have logged in.

Changing the Administrator Password



To change the admin password, from the menu bar choose <File> then <Change Password>. Enter the existing password, enter your new password and confirm. Click the <Update> button to submit the change, or click <Cancel>.

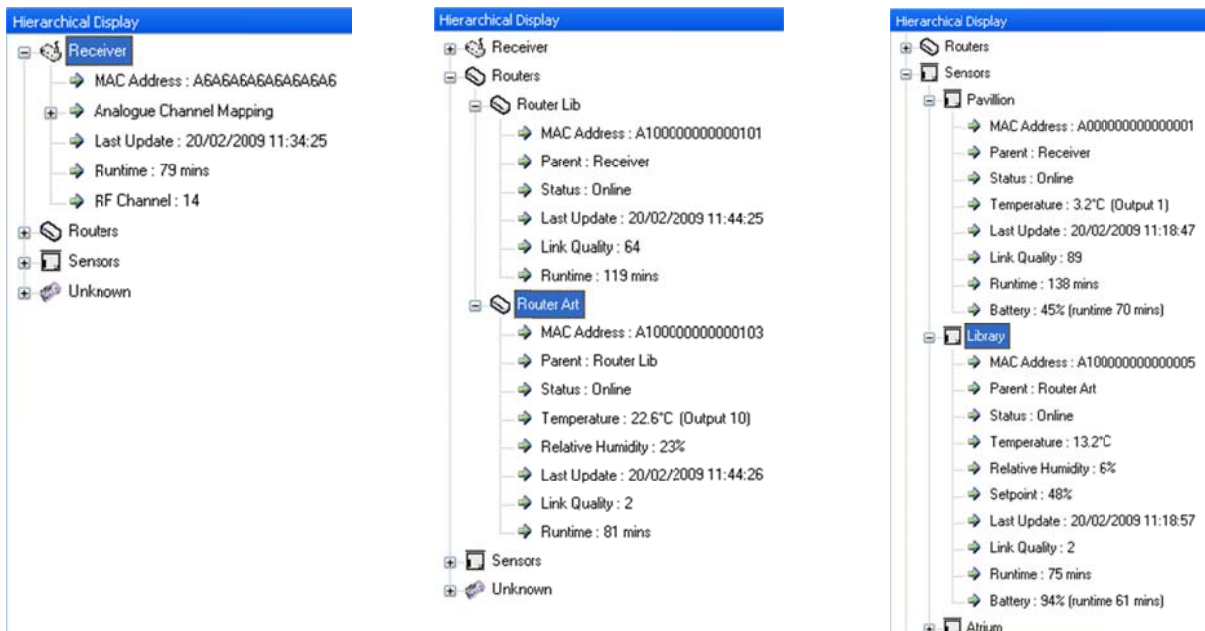
To prevent leaving the CMS in an admin state when not supervised, the admin log-in status automatically times out after the time set in the “Change Idle Time” setting expires. To disable this feature (not recommended), or to change the timeout value, from the menu bar choose <Options> then <Change Idle Time>



Removing the tick the Enable Idle Time Out box disables admin timeout feature. The timeout value can also be changed.

Listing Devices

In the text display panel on the left of the window, a list of all devices on the network can be found. These devices are divided into 3 main categories, receiver, routers and battery powered sensor nodes.



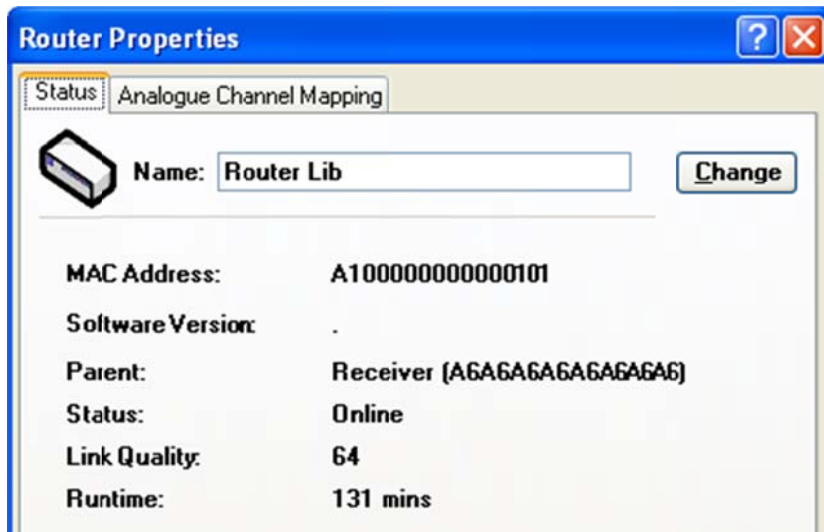
Each category can be expanded to view more detail or collapsed to hide detail.

The “Unknown” category is initially populated by devices which are joining the network for the first time, either by auto-commissioning or manual authorization. Devices are held in the unknown category until CMS has determined the type of device trying to join (for example, a router or node) and which options, if any, are fitted (such as setpoint). When CMS has determined this information, the device will then automatically be placed in it’s appropriate category.

NB The hand held monitor will only ever appear in the Unknown category. This is normal.

Changing Device Labels

Each device, when first depicted in the CMS, has a default label, such as “Router1” or “Sensor2”. To give the router a more meaningful label, right click on the router and choose <Properties>

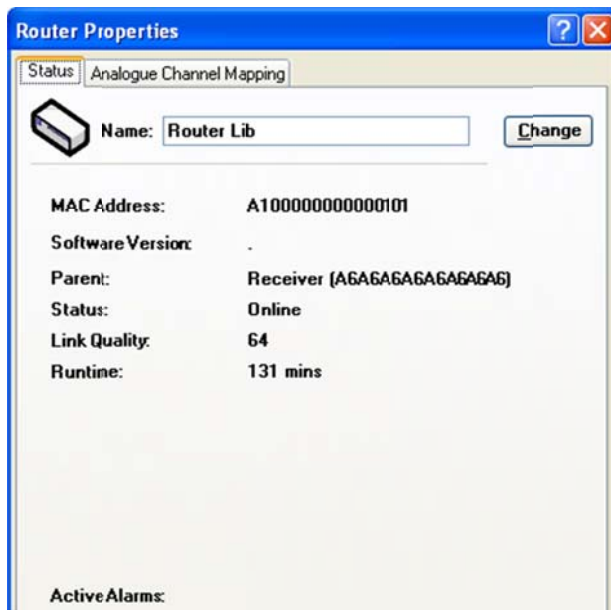


In the <Name> box, type in the new name you require and click the <Change> button.

NB There is a limit of 10 ASCII characters for router names.

To give a sensor a more meaningful label, right click on the sensor and choose <Properties>

Viewing Device Properties



The specific properties of any device can be viewed by right-clicking a device and selecting <Properties> in the drop-down menu.

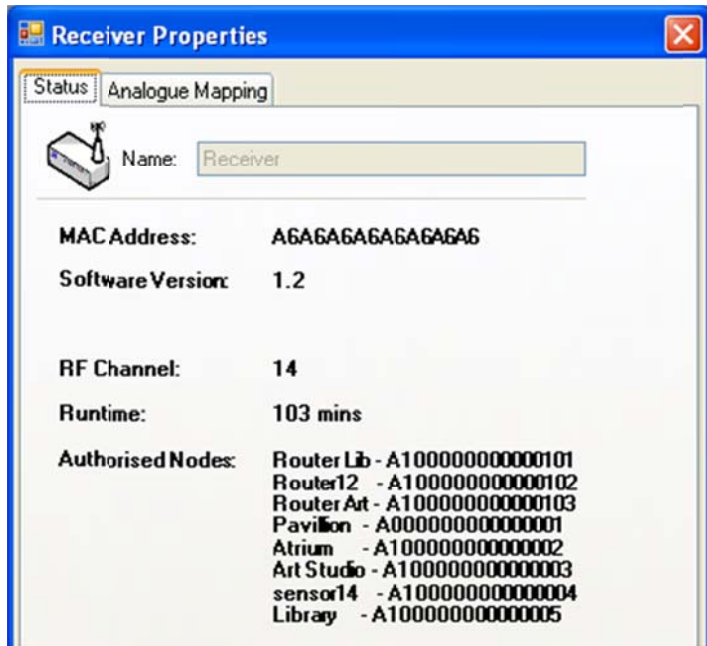
Available router properties are:

- Parent (if applicable)
- MAC address
- Software version
- Status
- Link Quality
- Runtime
- Any active alarms



Available sensor properties are:

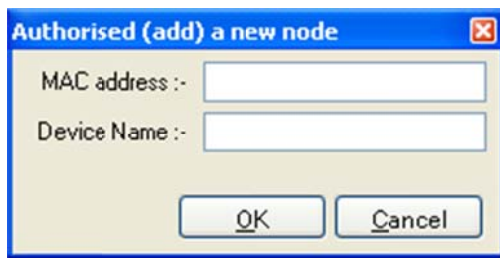
- Parent (if applicable)
- MAC address
- Software version
- Status
- Link Quality
- Runtime
- Battery level
- Any measured values
- Any active alarms



Available receiver properties are:

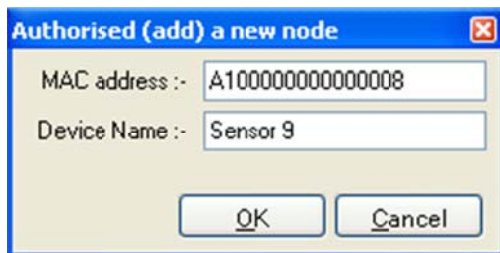
MAC address
Software version
RF channel used
Runtime
Authorised nodes

Authorising a new node



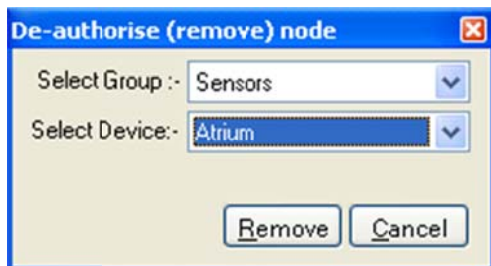
To manually authorise a new node(s), you must be logged on at administrator level. From the menu bar, click on [Options](#) and then select [Authorise \(add\) a new node](#) from the drop-down menu.

You will need to make a note of the unique 16-digit MAC address of the new node, found on the label on the device. Ensure the new device is powered on.



Enter this MAC address and a device label into the appropriate box fields and click [OK](#) to submit the details, or click [Cancel](#) to discard the information.

Removing a node from the network



To remove a node from the network, from the menu bar, click on [Options](#) and then select [De-authorise \(remove\) node](#) from the drop-down menu. Select the device group (routers or sensors) and then select the device by name (label).

Click [Remove](#) to submit the details, or click [Cancel](#) to discard the action.

Using the Graphical Map Display

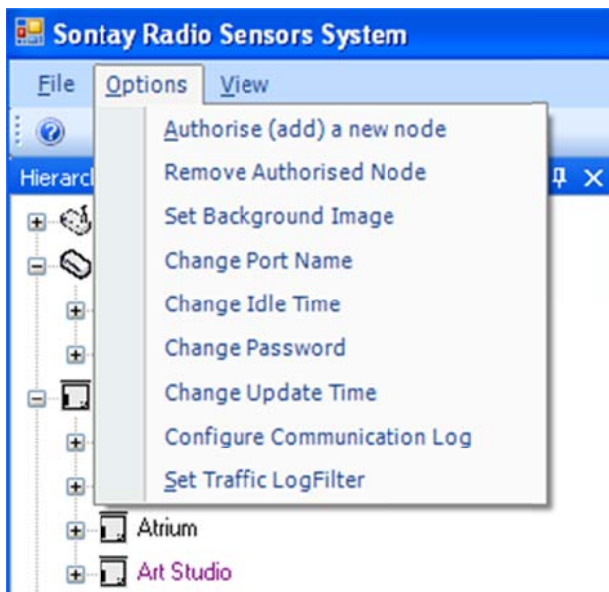
Apart from the text hierarchical display, the CMS offers a graphical environment which allows users to quickly determine how the network is functioning.

By default, there is no graphic image set as a backdrop for the map display.

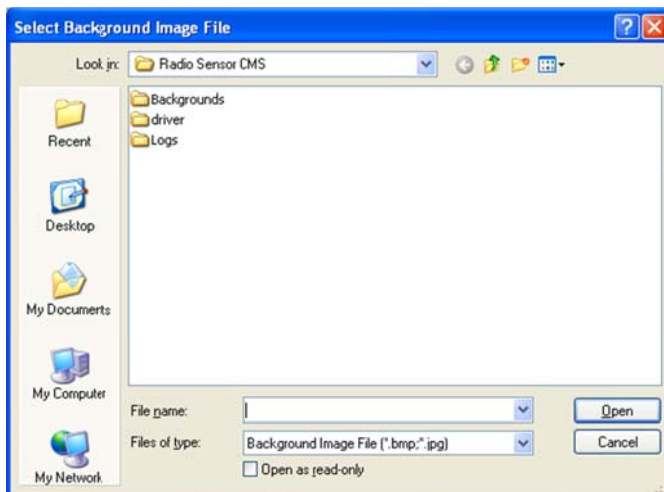
A typical image to use for the map display would be a floor plan of the environment in which the radio network has been installed.

Setting The Map Display Background Image

To set a background image for the map display, you must be logged on at administrator level.



From the menu bar, click on <Options> and then select <Set Background Image> from the drop-down menu.



Browse to the image file required. Image file formats currently supported are:

Bitmap (.bmp)
JPEG (.jpg)

Adding Devices To The Map Display

To add a device to the map display, simply “drag-and-drop” a device from the text hierarchical display onto the graphic background.

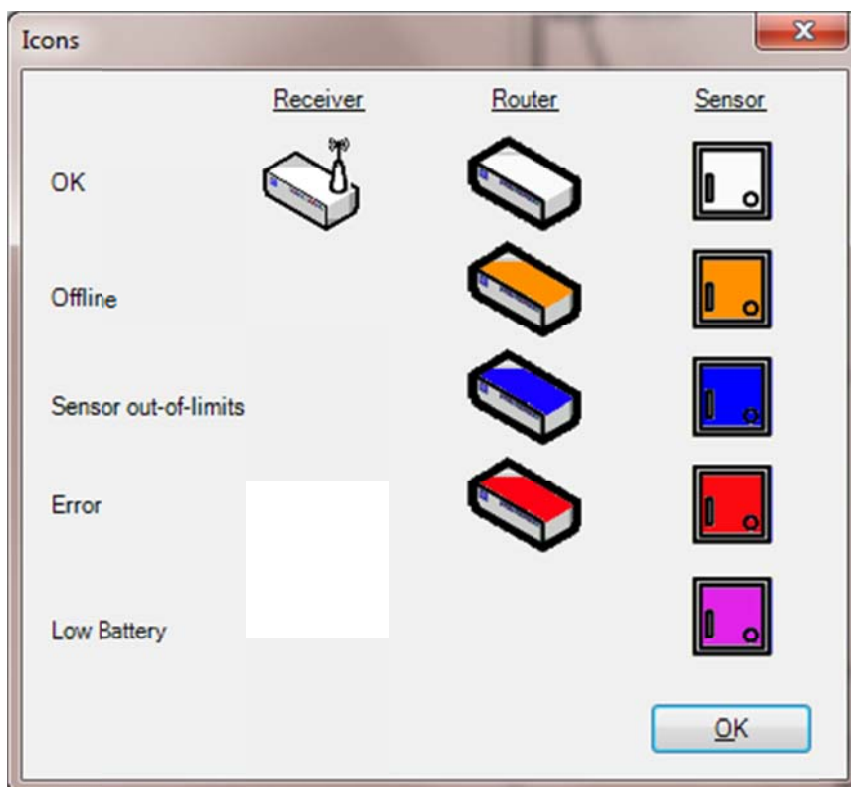
Add the receiver to the graphic first, then routers followed by battery powered nodes. Links are automatically generated, showing the true network architecture.

Different icons are used to depict the receiver, routers and battery powered node, making identification easy. The icons also depict the status of the device, and change to reflect whether a device is OK, off-line, or in alarm.

Icon Plan

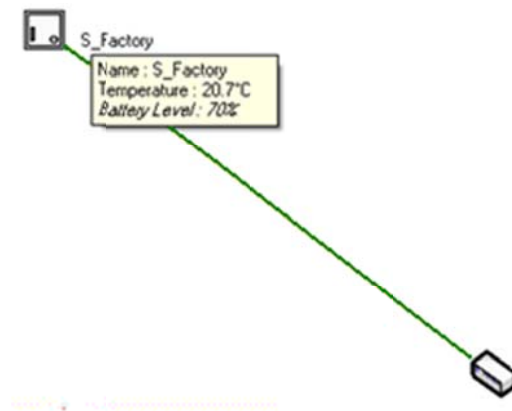
A schedule of what each icon and icon colour can be quickly found from the menu bar, click on <Help> and then select <Icons> from the drop-down menu.

The following pop-up window is displayed:



Device Status

A quick check on a device status can be made by hovering the mouse cursor over a device on the map display.



Displayed parameters are device dependent, but include:

- Device name (label)
- All sensor values
- Battery level (battery devices only)

NB Where link quality, hours run and battery level are shown in *italics*, this denotes that a request for data has been sent to a device, but the device has not yet responded.

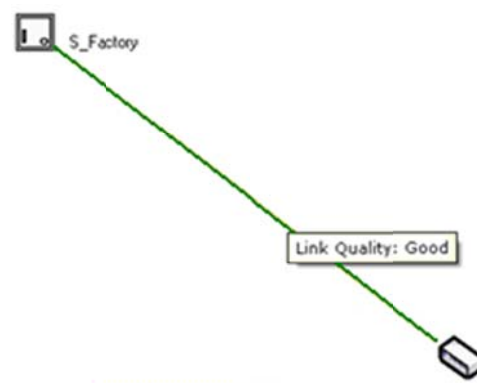
Link Status

The link status is represented graphically by the colour of the link drawn.



Green: Indicates good link quality.

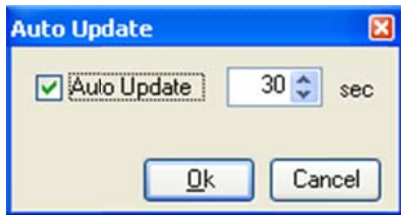
Red: Indicates marginal link quality.



A quick check on any link status can be made by hovering the mouse cursor over a link on the map display.

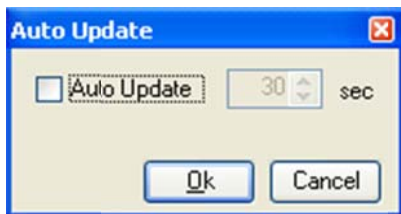
Auto Updating

The CMS can be configured to update at a user configurable rate.



From the menu bar, click on [Options](#) and then select [Change Update Time](#) from the drop-down menu. Adjust the update time accordingly. Click [OK](#) to submit the change, or click [Cancel](#) to discard the change.

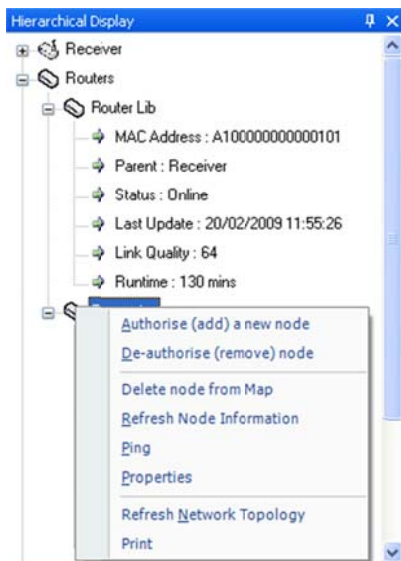
Auto updating can also be disabled.



From the menu bar, click on [Options](#) and then select [Change Update Time](#) from the drop-down menu. Remove the tick from the [Auto Update](#) box. Click [OK](#) to submit the change, or click [Cancel](#) to discard the change.

Manual Refreshing Of Data

Node or network data can be manually refreshed. This is an important feature when re-connecting the CMS to an existing network.



When re-connecting the CMS to a receiver on an existing network, data will only be refreshed to the CMS as and when a device updates it's information by timed transmission.

To ensure all data is sent as soon as possible, use the Refresh Node Information or Refresh Network Information options.

To manually refresh node data, right click on a node and then select [Refresh Node Information](#) from the drop-down menu.

To manually refresh network data, right click on a blank space (on the text or graphical display) and then select [Refresh Network Information](#) from the drop-down menu.

Communications Log

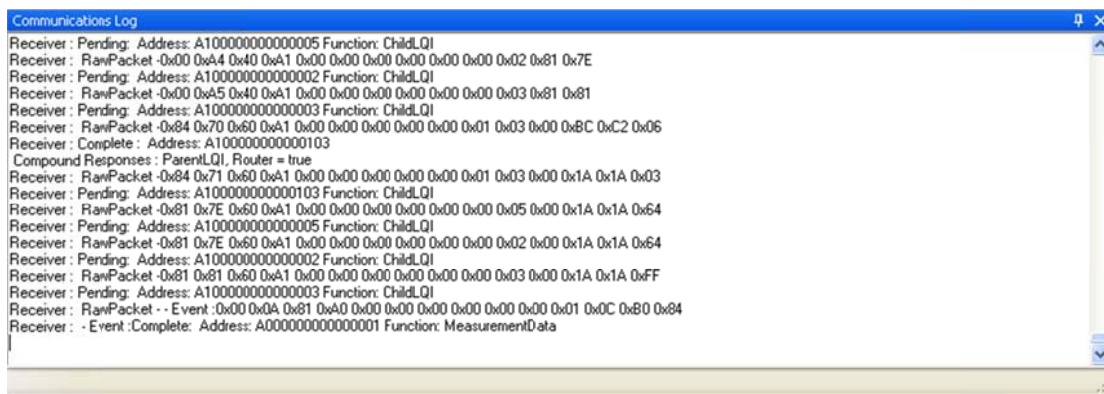
The CMS can keep a log of all communications on the network. This can be helpful in finding faults or diagnosing network problems.

By default, the communications log is enabled. If you want to disable this feature,

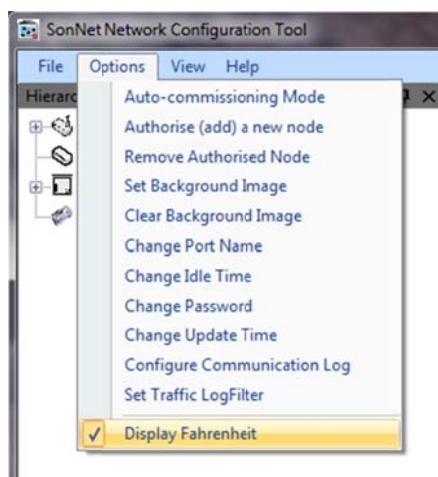


From the menu bar, click on [Options](#) and then select [Configure Communication Log](#) from the drop-down menu. Remove the tick from the [Enable Communication Log](#) box. Click [OK](#) to submit the change, or click [Cancel](#) to discard the change.

To view the communications log, from the menu bar choose [View](#) then [Communications Log](#). A window will appear at the bottom of the main CMS window. To close this view, click the cross in the top right of the communications log window.



Changing Display Units



To display temperatures in °F instead of °C, click on [Options](#) then tick [Display Fahrenheit](#).

This change affects mouse-over temperature values, significant change limit values, temperature values shown in the hierarchical

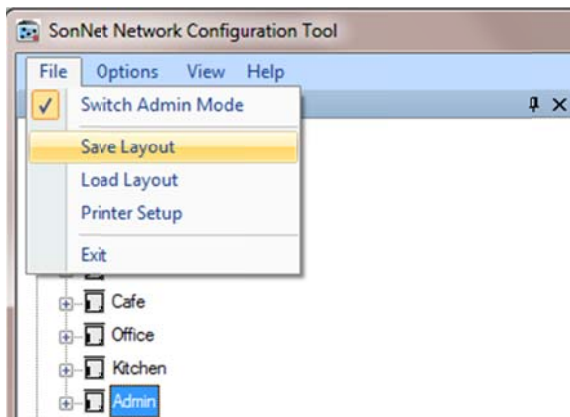
Using CMS To Document A Wireless Network

Saving and Opening Layouts

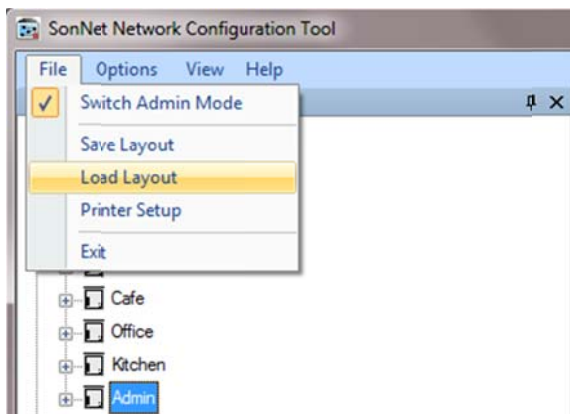
When a network is commissioned, it is very useful to save the graphical map layout to use as a reference and as the basis for comparison when checking the current status of network topology.

Saving a layout records the backdrop (if used) and the position and size of each device icon on the map display.

To save a layout, click on <File> then <Save Layout>



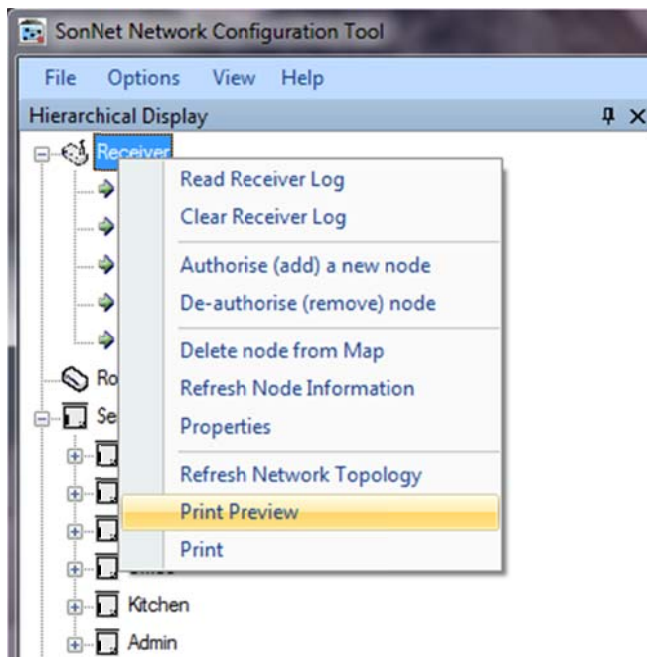
To open a saved layout, click on <File> then <Load Layout>



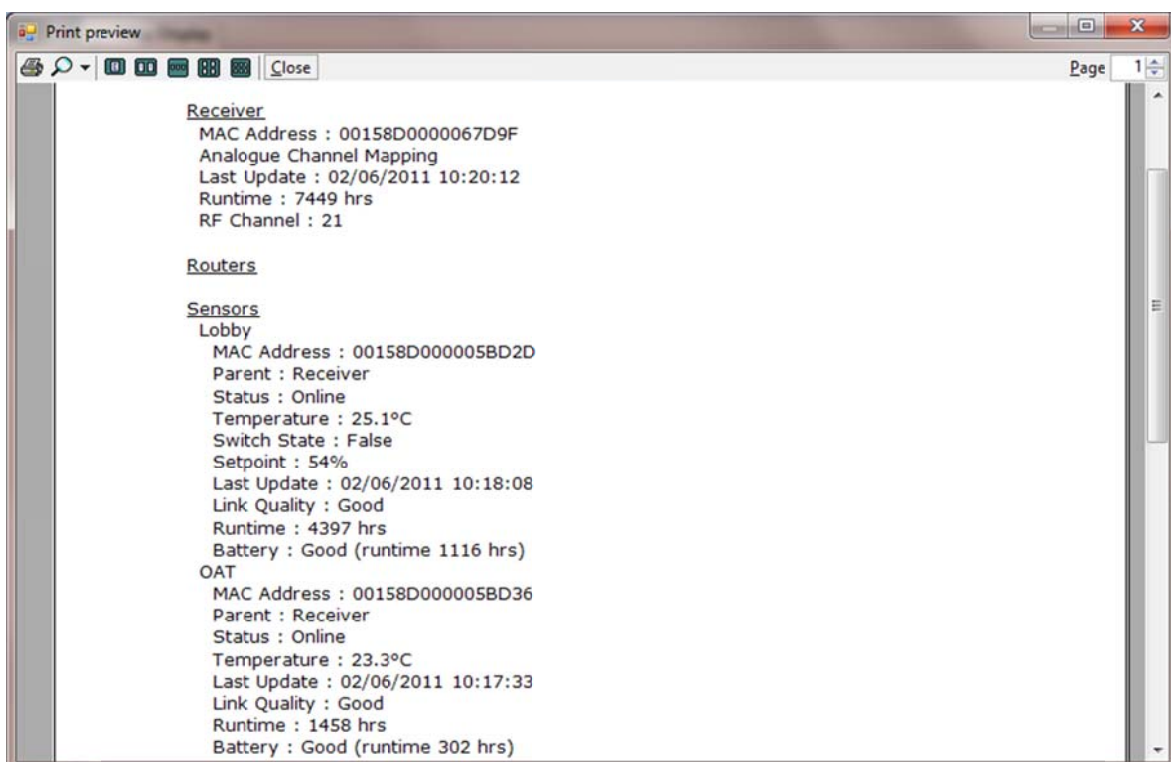
A library of site layouts can be formed as a reference.

Receiver Print Preview

To generate a comprehensive text document of network devices, from the hierarchical display, right-click on the receiver object, and from the menu select <Print Preview>.



A document is automatically generated, which can be printed on paper for an O&M manual, or to .PDF file, for example.



Conducting a Site Survey: A Step-By-Step Guide

1. Ensure all SSK device batteries in the SSK kit are fully charged.
2. Place the SSK receiver where the system receiver will finally be installed. **NB** - it is extremely important that if the system receiver is to be mounted in an enclosed panel (metal or plastic) so that an external aerial extension is used, an SSK receiver extension aerial must be used and placed where the system receiver aerial will be finally be installed. Two extension aerals are available from Sontay, a 2 metre version **RF-AERIAL-PM2** and a 5 metre version **RF-AERIAL-PM5**.
3. Fit the aerial to the SSK receiver, or if using an aerial extension, to the bulk head jack connector.
4. Ensure, where possible, that the receiver aerial is aligned vertically, and as far away from obstructions as possible.
5. Referencing site floor plans where possible, place SSK end devices (SSK EDs) in their appropriate positions, taking care to ensure that the sensors are not placed;
 - a. In direct sunlight or near a source of heat
 - b. On a cold or hot outside wall, where conducted or radiant heat may affect the reading
 - c. Behind any obstruction likely to impede the radio signal (for example, a filing cabinet)
 - d. Ensure that each space housing SSK ED is mounted with the tamperproof screw at the bottom. This ensures the integral PCB aerial is in the correct alignment.
6. Do NOT switch on SSK EDs until the receiver is installed.
7. Switch on the SSK receiver. If this is the first time the receiver has been commissioned, note that the red LED near the reset button is flashing. This indicates that the SSK receiver has no child devices on the network.
 - a. If using CMS, connect the SSK receiver's USB connector to a laptop or PC with CMS installed.
 - b. If required, install the 2 drivers required for CMS (see page 26). Windows 7 users, please see page 21
 - c. Start CMS by double-clicking the desktop icon. Select the required com port (see page 27). Log on at admin level (see page 29 and 30).
 - d. If required, add a background image to CMS map display (see page 35).
 - e. Using CMS, ensure that the receiver appears in the hierarchical display. Add to the map display by drag-and-drop.
8. Switch on the HHM.
9. After initialisation, the LCD will display the SSK receiver.
10. Switch on the SSK EDs using the switch on the back cover, starting with those closest to the receiver. The LCD will display a list of SSK EDs which are connected directly to the receiver, together with their link quality index (LQI).
 - a. To get further information about a device, use the Up/Down arrow keys to select that device, then press the right arrow key to view more detailed information.
 - b. To display the MAC address and firmware revision number, use the right arrow key to select "more" then press the OK key.
 - c. To go back to the main device list, use the Up/Down arrow keys to select "back", then press the OK key.
 - d. If using CMS, ensure that all the SSK EDs appear in the hierarchical display.
11. Using the HHM (or CMS), observe whether each battery powered sensor node has communication back to the SSK receiver. If it does, observe the link quality, shown on the LCD display.
 - a. If the link quality is shown as good or v. good, no router is required for this node. Go to step 12.
 - b. If there is no communication, or link quality is shown as marginal to the SSK receiver, you will need to position a router between the node and receiver.
 - c. In this case, position a router between the node and receiver in a convenient location, remembering that a system router in the final installation will require a permanent 24Vac/dc supply.
 - d. Ensure, where possible, that the router aerals are aligned vertically, and as far away from obstructions as possible.
 - e. Observe the HHM again. The new router should be registered on the HHM.

- f. In the HHM display, where a listed device is a router, to the right of that device will be a number which denotes the number of “children” the router has.
 - g. Using the HHM, observe the link quality for the new router to the receiver. If the link is shown as good, proceed to step 11h. If the link quality is shown as marginal, select the new router and then navigate to “Verification” on the HHM menu. Press the OK key to force the new router into verification mode. The node will go off-line for a short period, then re-join in verification mode. The router will now try to find a better communications path back to the receiver via another router, if there is one already installed. Note the link quality and the position of the router. It is recommended that a drawing or floor plan be used to mark device positions.
 - h. Using the HHM, select the node and then navigate to “Verification” on the HHM menu. Press the OK key to force the new node into verification mode. The node will go off-line for a short period, then re-join in verification mode. Note the link quality and the exact position of the router.
 - i. Where a router or node has been placed into verification mode, it must be returned to normal operating mode by resetting or power cycling prior to moving to step 12. If left unattended for more than 5 minutes, a router or node placed into verification mode will automatically return to normal mode.
12. Continue placing battery powered sensor nodes (and routers if required), until battery powered sensor nodes have been tested at the required points, good quality links are shown for all devices on the HHM, and complete coverage is demonstrated.
 13. When configuration is complete, save the map display layout (see page 39).
 14. Generate a report of the completed network to document it for future reference (see page 40).

Best Practise Points:

1. Always conduct a site survey, and ensure that if you plan to use an external extension aerial on the system receiver (for example, if the receiver is to be in a metal panel), you use the same external extension aerial on the SSK receiver for the survey. Document the survey thoroughly, and leave a copy on site.
2. When planning where routers are going to be needed, plan for “redundancy”, i.e. what happens to all the EDs connected to a router if the router fails? Backup routers are worth considering. See pages 11 - 13.
3. Generally speaking, wireless works best in a horizontal plane, so expect reduced signal strength if the receiver is on a different floor to the routers/EDs. A good rule of thumb is have the receiver on the same floor as it's children, though this isn't always the case.
4. 2.4GHz wireless signals don't go through metal! Plan to circumvent metal obstructions where possible.
5. If the installation environment is one where obstructions are likely to change regularly (in a warehouse, for example!), try to conduct the site survey under a “worst-case” scenario - i.e. assume that at some point, there's going to be an obstruction between the ED/router and it's parent at some time. Simulate it, if possible.
6. Remember that when a receiver scans all 16 channels for the best one, the channel chosen is the best *where the receiver is*. On “long” networks with several “layers” of routers, the channel chosen by the receiver may not always be the quietest at the far end of the network. When the installed network is finally formed, press the receiver reset button and ensure the network reforms properly. This will ensure that, in the event that the receiver needs to change channels (for example), it will work seamlessly.
7. As each network is commissioned, save the layout - even if there isn't a background graphic loaded. This is a good aid to quickly viewing network topology.
8. Document each network! In CMS, right-click on the receiver in the hierarchical display and select “Print Preview” from the menu and print (to paper or a file, such as .PDF) the preview document. This gives a reference to call on at a later date if required.

Trouble-Shooter's Guide

SSK Receiver		
Symptom	Cause	Actions
LED flashing once per second	The SSK receiver has found no children on the network	Check aerial and extension co-ax (if fitted)
		Ensure the SSK receiver has all SSK devices authorized
		Ensure SSK network devices are switched on and in range
LED on SSK receiver not lit at all	No power to SSK receiver	Ensure battery is fully charged
	Battery charged still connected to SSK receiver	Remove battery charger from SSK receiver
	SSK Receiver not switched on	Switch on SSK receiver
SSK HHM		
Symptom	Cause	Actions
No connectivity to SSK receiver	The HHM has not been authorized to the SSK receiver	Manually authorize HHM to SSK receiver
	No radio connection	Check aerial on HHM and SSK receiver
	SSK receiver not switched on	Switch SSK receiver on
	HHM not switched on	Switch HHM on
	Flat HHM battery	Charge HHM battery
	Flat SSK receiver battery	Charge SSK receiver battery
SSK ED		
Symptom	Cause	Actions
No connectivity to SSK receiver	SSK ED has not been authorized to the SSK receiver	Manually authorize SSK ED to SSK receiver
	No radio connection	Check aerial on SSK receiver
	SSK receiver not switched on	Switch SSK receiver on
	SSK ED not switched on	Switch SSK ED on
	Flat SSK ED battery	Charge SSK ED battery
	Flat SSK receiver battery	Charge SSK receiver battery
SSK ED goes off-line	Auto-time out after 4 hours	Power cycle SSK ED
SSK Router		
Symptom	Cause	Actions
No connectivity to SSK receiver	SSK router has not been authorized to the SSK receiver	Manually authorize SSK router to SSK receiver
	No radio connection	Check aerial on SSK receiver and SSK router
	SSK receiver not switched on	Switch SSK receiver on
	SSK router not switched on	Switch SSK router on
	Flat SSK router battery	Charge SSK router battery
	Flat SSK receiver battery	Charge SSK receiver battery
SSK router goes off-line	Auto-time out after 4 hours	Power cycle SSK router

CMS		
Symptom	Cause	Actions
CMS doesn't start	No receiver connected to PC	Connect receiver to PC using USB cable
	Receiver not switched on	Switch on receiver
	Drivers not installed	Install drivers
	Another instance of CMS is already running on the PC	Only one instance of CMS can run at a time
Some menu items are greyed out	Not logged in as admin	Log in at admin level
	Admin level timed out	Log in at admin level
Map display not visible	Graphical display not selected	Select graphical display
Text display not visible	Text display not selected	Select text display
Device in Sensor tree is shown in blue	Device not on map display	Drag-and-drop onto map display
Device in Router tree is shown in blue	Device not on map display	Drag-and-drop onto map display
Links in map display are not in colour	Not logged in as admin	Log in at admin level
When I request node information, the data doesn't come back immediately	Normal - an ED will only send this data the next time it wakes	Wait for devices to report latest values to the receiver